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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,822	02/05/2004	Vijayan Rajan	112056-0159 / P01-1727	5952

24267 7590 06/27/2008

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EXAMINER	
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ART UNIT	PAPER NUMBER
2185	

MAIL DATE	DELIVERY MODE
06/27/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/772,822	RAJAN ET AL.	
	Examiner	Art Unit	
	Arpan P. Savla	2185	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 March 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15,19,20 and 23-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15,19,20 and 23-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

This Office action is in response to Applicant's communication filed March 26, 2008 in response to the Office action dated December 26, 2007. Claims 1, 5, 27, and 35 have been amended. New claims 40-42 have been added. Claims 1-15, 19, 20, and 23-42 are pending in this application.

OBJECTIONS

Claims

1. In view of Applicant's amendment, the objections to **claims 1, 5, 27, and 35** are withdrawn.

2. **Claim 41** is objected to because the claim recites the limitation "**the** processor to reference" on line 10, however, there is insufficient antecedent basis for this limitation in the claim. Applicant may consider amending the claim to instead read "**a** processor to reference."

REJECTIONS BASED ON PRIOR ART

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the

applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 23, 31, and 39 rejected under 35 U.S.C. 102(e) as being anticipated by Cameron et al. (U.S. Patent 7,165,156) (hereinafter "Cameron").

4. **As per claims 23 and 39**, Cameron discloses a method for operating a data storage system, comprising:

creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at a location referencing data which has not been changed since the writable vdisk was created (col. 1, lines 61-64; col. 7, lines 14-17; Fig. 1, element 202; Fig. 7, element 602); *It should be noted that the computer readable medium of claim 39 executes the exact same functions as the method of claim 23. Therefore, any reference(s) that teach claim 23 also teach corresponding claim 39. It should also be noted that ""RWSS 202" is analogous to the "writable vdisk." Lastly, it should also be noted that for a distinct period of time between when RWSS 202 is created and when RWSS 202 receives its first write, RWSS 202 is completely filled with all "holes."*

maintaining a backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *It should be noted that "ROSS 204-j" is analogous to the "backing store."*

searching each field of the writable vdisk for a hole; and referencing each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created (col. 7, lines 18-24). *It should be noted that between the time RWSS 202 is created and ROSS 204-j is created, there are no writes to RWSS 202, therefore, all the blocks in RWSS 202 are "holes." Thus, at the point in time when ROSS 204-j is created from RWSS 202, in effect all the "holes" (i.e. blocks) in RWSS 202 are "searched" in order for each hole/block in RWSS 202 to be properly referenced to point to the corresponding block referenced by ROSS 204-j. In other words, the mere creation of ROSS 204-j from RWSS 202 [in the case where this occurs before there have been any writes to RWSS 202] inherently requires Cameron to perform both the "searching" and "referencing" as described in the claims above. It should also be noted that RWSS 202 references both data which is unchanged (using ROSS 204-j as described above) and data which has been changed (Fig. 7, element 616) since (i.e. after) RWSS 202 was created.*

5. **As per claim 31**, Cameron discloses a data storage system, comprising:

a writable virtual disk (vdisk) created at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at a location referencing data which has not been changed since the writable vdisk was

created (col. 1, lines 61-64; col. 7, lines 14-17; Fig. 1, element 202; Fig. 7, element 602); *See the citation note for the similar limitation in claims 23 and 39 above.*

a backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *See the citation note for the similar limitation in claims 23 and 39 above.*

a processor to search each field of the writable vdisk for a hole; and the processor to reference each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created (col. 2, lines 31-35; col. 7, lines 18-24). *See the citation note for the similar limitation in claims 23 and 39 above.*

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-15, 19, 20, and 24-30, and 32-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cameron in view of Haskin et al. (U.S. Patent Application Publication 2003/0158863) (hereinafter "Haskin").

8. **As per claims 1 and 20**, Cameron discloses a method for operating a data storage system, comprising:

creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at a location referencing data which has not been changed since the writable vdisk was created (col. 1, lines 61-64; col. 7, lines 14-17; Fig. 1, element 202; Fig. 7, element 602); *See the citation note for the similar limitation in claims 23 and 39 above.*

maintaining a backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *It should be noted that the computer readable medium of claim 20 executes the exact same functions as the method of claim 1. Therefore, any reference(s) that teach claim 1 also teach corresponding claim 20. Also, see the citation note for the similar limitation in claims 23 and 39 above.*

searching each field of the writable vdisk for a hole; and referencing each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created (col. 7, lines 18-24). *See the citation note for the similar limitation in claims 23 and 39 above.*

Cameron does not expressly disclose loading blocks of the writable vdisk from a disk into a memory, the loaded blocks including a writable vdisk indirect block having a plurality of fields, each field storing a valid pointer to a data block or an invalid pointer representing a particular hole of the plurality of holes;

loading blocks of the backing store from a disk into memory, the loaded blocks including a backing store indirect block having a plurality of fields, each backing store indirect field corresponding to a field of the writable vdisk indirect block, one or more backing store indirect block fields having a pointer to a data block.

Haskin discloses loading blocks of the writable vdisk from a disk into a memory, the loaded blocks including a writable vdisk indirect block having a plurality of fields, each field storing a valid pointer to a data block or an invalid pointer representing a particular hole of the plurality of holes (paragraph 0053; paragraph 0063; Fig. 2B);

loading blocks of the backing store from a disk into memory, the loaded blocks including a backing store indirect block having a plurality of fields, each backing store indirect field corresponding to a field of the writable vdisk indirect block, one or more backing store indirect block fields having a pointer to a data block (paragraph 0053; paragraph 0095; Fig. 8D); *It should be noted that the "snapshot data set" is analogous to the "backing store."*

Haskin and Cameron are analogous art because they are from the same field of endeavor, that being file system snapshots.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply Haskin's ditto address feature to Cameron's snapshots because

all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded the predictable results of efficiently utilizing system kernel memory within data processing equipment to support time sensitive processing tasks such as external data communications processing.

Therefore, it would have been obvious to combine Cameron and Haskin for the benefit of obtaining the invention as specified in claims 1 and 20.

9. **As per claim 2**, the combination of Haskin/Cameron discloses dirtying the data block pointed to by the backing store indirect block to enable write allocation of the dirty data block without altering a data content of the data block (Haskin, paragraph 0079). *It should be noted that replacing the address of the allocated block is in effect "dirtying" the block without altering the content.*

10. **As per claim 3**, the combination of Haskin/Cameron discloses

choosing a new pointer for a newly allocated data block containing the unaltered data content (Haskin, paragraph 0081); *It should be noted that the "ditto disk address" acts as the "new pointer" for the newly allocated indirect block.*

setting bits in block allocation structures for the newly allocated data block (Haskin, paragraph 0058). *It should be noted that the "block allocation map" is analogous to the "block allocation structures."*

placing the new pointer to the newly allocated data block into the field of the writable vdisk indirect block to replace the hole (Cameron, col. 7, lines 18-20; Fig. 7, element 604).

11. **As per claim 4**, the combination of Haskin/Cameron discloses freeing the dirty data block (Haskin, paragraph 0177); *It should be noted that "deleting" is analogous to "freeing."*

writing the newly allocated data block to disk (Haskin, paragraph 0177). *It should be noted that "flushing disk access buffers to disk" is analogous to "writing to disk."*

12. **As per claim 5**, the combination of Haskin/Cameron discloses releasing an association of the writable vdisk to the backing store to thereby separate the writable disk data blocks from the backing store data blocks (Haskin, paragraph 0112). *It should be noted that by "deleting" the snapshot it follows that all associations with the original file system are "released."*

13. **As per claim 6**, the combination of Haskin/Cameron discloses the pointers contained in the writable vdisk indirect block fields and the backing store indirect block fields comprise logical block numbers (VBNs) (Haskin, paragraph 0096).

14. **As per claim 7**, the combination of Haskin/Cameron discloses the invalid pointers contained in the writable vdisk indirect block fields comprise a zero logical volume block number (VBN) (Haskin, paragraph 0072). *It should be noted that "null" values for the disk addresses indicate unallocated blocks, thus, it follows that unallocated blocks have invalid pointers.*

15. **As per claim 8**, the combination of Haskin/Cameron discloses the plurality of fields in the writable vdisk indirect block are a writable vdisk level 1 buffer and the plurality of fields in the backing store indirect block are a backing store level 1 buffer

(Haskin, paragraph 0055). *It should be noted that the "inodes" function as "level 1 buffers."*

16. **As per claim 9**, Cameron discloses an apparatus for operation a computer data base, comprising:

a writable virtual disk (vdisk) created at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at locations referencing data which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *See the citation note for the similar limitation in claims 23 and 39 above.*

a backing store, the backing store referencing data stored in the data storage system which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *See the citation note for the similar limitation in claims 23 and 39 above.*

a special loading function for searching each field of the writable vdisk indirect block for one or more fields representing a hole; and a write allocator for replacing each field representing a hole in the writable vdisk indirect block with a new pointer to the data referenced by the corresponding backing store indirect block field to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created (col. 2, lines 31-35; col. 7, lines 18-24). *It should be noted that the "storage management program" provides the functionality of the "special loading function" and*

the "write allocator." Also, see the citation note for the similar limitation in claims 23 and 39 above.

Cameron does not expressly disclose a backdoor message handler adapted to load blocks of the writable vdisk and backing store from disk into the storage system.

a writable vdisk indirect block in memory having a plurality if fields, each field storing a valid pointer to a data block or an invalid pointer representing a hole.

a backing store indirect block in the memory having a plurality if fields, each backing store indirect block field corresponding to a field of the writable vdisk indirect block, each backing store indirect block field having a pointer to a data block.

Haskin discloses a backdoor message handler adapted to load blocks of the writable vdisk and backing store from disk into the storage system (paragraph 0053); *It should be noted that Haskin's "computer processing device" (paragraph 0050) functions as a "backdoor message handler."*

a writable vdisk indirect block in memory having a plurality if fields, each field storing a valid pointer to a data block or an invalid pointer representing a hole (paragraph 0063; Fig. 2B).

a backing store indirect block in the memory having a plurality if fields, each backing store indirect block field corresponding to a field of the writable vdisk indirect block, each backing store indirect block field having a pointer to a data block (paragraph 0095; Fig. 8D); *See citation note for the similar limitation in claim 1 above.*

Haskin and Cameron are analogous art because they are from the same field of endeavor, that being file system snapshots.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply Haskin's ditto address feature to Cameron's snapshots because all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded the predictable results of efficiently utilizing system kernel memory within data processing equipment to support time sensitive processing tasks such as external data communications processing.

Therefore, it would have been obvious to combine Cameron and Haskin for the benefit of obtaining the invention as specified in claim 9.

17. **As per claim 10**, the combination of Haskin/Cameron discloses a new pointer for a newly allocated data block containing an unaltered data content (Haskin, paragraph 0081), set bits in block allocation structures for the newly allocated data block (Haskin, paragraph 0058), and place the new pointer to the newly allocated data block into the field of the writable vdisk indirect block to replace the hole (Cameron, col. 7, lines 18-20; Fig. 7, element 604). *See the citation notes for claim 3 above.*

18. **As per claim 11**, the combination of Haskin/Cameron discloses the write allocator is further adapted to:

free the dirty data block and write the newly allocated data block to disk (Haskin, paragraph 0177). *See the citation notes for claim 4 above.*

19. **As per claim 12**, the combination of Haskin/Cameron discloses the backdoor handler loads blocks of writable vdisk and the blocks of the backing store during periods of reduced processing activity (Haskin, paragraph 0053). *It should be noted that the*

blocks are loaded during periods other than when the blocks are being updated, thus when compared to periods of block updating, the loading periods have reduced processing activity.

20. **As per claim 13**, the combination of Haskin/Cameron discloses the pointers contained in the writable vdisk indirect block fields and the backing store indirect block fields comprise logical block numbers (VBNs) (Haskin, paragraph 0096).

21. **As per claim 14**, the combination of Haskin/Cameron discloses the invalid pointers contained in the writable vdisk indirect block fields comprise a zero logical volume block number (VBN) (Haskin, paragraph 0072). *See the citation note for claim 7 above.*

22. **As per claim 15**, the combination of Haskin/Cameron discloses the plurality of fields in the writable vdisk indirect block are a writable vdisk level 1 buffer and the plurality of fields in the backing store indirect block are a backing store level 1 buffer (Haskin, paragraph 0055). *See the citation note for claim 8 above.*

23. **As per claim 19**, Cameron discloses a method for operating a data storage system, comprising:

means for creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at a location referencing data which has not been changed since the writable vdisk was created (col. 1, lines 61-64; col. 7, lines 14-17; Fig. 1, element 202; Fig. 7, element 602); *See the citation note for the similar limitation in claims 23 and 39 above.*

means for maintaining a backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *It should be noted that the computer readable medium of claim 20 executes the exact same functions as the method of claim 1. Therefore, any reference(s) that teach claim 1 also teach corresponding claim 20. Also, see the citation note for the similar limitation in claims 23 and 39 above.*

means for searching each field of the writable vdisk for a hole; and means for referencing each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created (col. 7, lines 18-24). *See the citation note for the similar limitation in claims 23 and 39 above.*

Cameron does not expressly disclose means for loading blocks of the writable vdisk from a disk into a memory, the loaded blocks including a writable vdisk indirect block having a plurality of fields, each field storing a valid pointer to a data block or an invalid pointer representing a particular hole of the plurality of holes;

means for loading blocks of the backing store from a disk into memory, the loaded blocks including a backing store indirect block having a plurality of fields, each backing store indirect field corresponding to a field of the writable vdisk indirect block, one or more backing store indirect block fields having a pointer to a data block.

Haskin discloses means for loading blocks of the writable vdisk from a disk into a memory, the loaded blocks including a writable vdisk indirect block having a plurality of fields, each field storing a valid pointer to a data block or an invalid pointer representing a particular hole of the plurality of holes (paragraph 0053; paragraph 0063; Fig. 2B);

means for loading blocks of the backing store from a disk into memory, the loaded blocks including a backing store indirect block having a plurality of fields, each backing store indirect field corresponding to a field of the writable vdisk indirect block, one or more backing store indirect block fields having a pointer to a data block (paragraph 0053; paragraph 0095; Fig. 8D); *It should be noted that the "snapshot data set" is analogous to the "backing store."*

Haskin and Cameron are analogous art because they are from the same field of endeavor, that being file system snapshots.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply Haskin's ditto address feature to Cameron's snapshots because all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded the predictable results of efficiently utilizing system kernel memory within data processing equipment to support time sensitive processing tasks such as external data communications processing.

Therefore, it would have been obvious to combine Cameron and Haskin for the benefit of obtaining the invention as specified in claim 19.

24. **As per claim 24**, the combination of Haskin/Cameron discloses dirtying the data block pointed to by the backing store indirect block to enable write allocation of the dirty data block without altering a data content of the data block (Haskin, paragraph 0079). *See the citation note for claim 2 above.*

25. **As per claim 25**, the combination of Haskin/Cameron discloses

choosing a new pointer for a newly allocated data block containing the unaltered data content (Haskin, paragraph 0081); *See the citation note for claim 3 above.*

setting bits in block allocation structures for the newly allocated data block (Haskin, paragraph 0058). *See the citation note for claim 3 above.*

placing the new pointer to the newly allocated data block into the field of the writable vdisk indirect block to replace the hole (Cameron, col. 7, lines 18-20; Fig. 7, element 604).

26. **As per claim 26**, the combination of Haskin/Cameron discloses freeing the dirty data block (Haskin, paragraph 0177); *See the citation note for claim 4 above.*

writing the newly allocated data block to disk (Haskin, paragraph 0177). *See the citation note for claim 4 above.*

27. **As per claim 27**, the combination of Haskin/Cameron discloses releasing an association of the writable vdisk to the backing store to thereby separate the writable disk data blocks from the backing store data blocks (Haskin, paragraph 0112). *See the citation note for claim 5 above.*

28. **As per claim 28**, the combination of Haskin/Cameron discloses including logical volume block numbers (VBNs) in the pointers contained in the writable vdisk indirect block fields and the backing store indirect block fields (Haskin, paragraph 0096).

29. **As per claim 29**, the combination of Haskin/Cameron discloses using a zero logical volume block number (VBN) as the invalid pointers contained in the writable vdisk indirect block fields (Haskin, paragraph 0072). *See the citation note for claim 7 above.*

30. **As per claim 30**, the combination of Haskin/Cameron discloses the plurality of fields in the writable vdisk indirect block are a writable vdisk level 1 buffer and the plurality of fields in the backing store indirect block are a backing store level 1 buffer (Haskin, paragraph 0055). *See the citation note for claim 8 above.*

31. **As per claim 32**, the combination of Haskin/Cameron discloses the data block pointed to by the backing store are dirtied to enable write allocation of the dirty data block without altering a data content of the data block (Haskin, paragraph 0079). *See the citation note for claim 2 above.*

32. **As per claim 33**, the combination of Haskin/Cameron discloses a new pointer chosen for a newly allocated data block containing unaltered data content (Haskin, paragraph 0081), bits are set in a block allocation structures for the newly allocated data block (Haskin, paragraph 0058), and a new pointer to the newly allocated data block placed into a field of the writable vdisk indirect block to replace the hole (Cameron, col. 7, lines 18-20; Fig. 7, element 604). *See the citation notes for claim 3 above.*

33. **As per claim 34**, the combination of Haskin/Cameron discloses

the dirty block is freed; and the newly allocated data block is written to disk (Haskin, paragraph 0177). *See the citation notes for claim 4 above.*

34. **As per claim 35**, the combination of Haskin/Cameron discloses an association of the writable vdisk to the backing store is released to thereby separate the writable vdisk data blocks from the backing store data blocks (Haskin, paragraph 0112). *See the citation note for claim 5 above.*

35. **As per claim 36**, the combination of Haskin/Cameron discloses logical volume block numbers (VBNs) included in the pointers contained in the writable vdisk indirect block fields and the backing store indirect block fields. (Haskin, paragraph 0096).

36. **As per claim 37**, the combination of Haskin/Cameron discloses a zero logical volume block number (VBN) used as the invalid pointers contained in the writable vdisk indirect block fields (Haskin, paragraph 0072). *See the citation note for claim 7 above.*

37. **As per claim 38**, the combination of Haskin/Cameron discloses a writable vdisk level 1 buffer used for the plurality of fields in the writable vdisk indirect block and a backing store level 1 buffer used for the plurality of fields in the backing store indirect block (Haskin, paragraph 0055). *See the citation note for claim 8 above.*

38. Claims 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cameron in view of Armangau et al. (U.S. Patent 6,792,518) (hereinafter "Armangau").

39. **As per claims 40 and 42**, Cameron discloses a method for operating a data storage system, comprising:

creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at a location referencing data which has not been changed since the writable vdisk was created (col. 1, lines 61-64; col. 7, lines 14-17; Fig. 1, element 202; Fig. 7, element 602); *It should be noted that the computer readable medium of claim 42 executes the exact same functions as the method of claim 40. Therefore, any reference(s) that teach claim 40 also teach corresponding claim 42. Also, see the citation note for the same limitation in claims 23 and 39 above.*

maintaining a backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *See the citation note for the same limitation in claims 23 and 39 above.*

searching each field of the writable vdisk for a hole; and referencing each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created (col. 7, lines 18-24). *See the citation note for the same limitation in claims 23 and 39 above.*

Cameron does not disclose searching done by a background task process.

Armangau discloses searching done by a background task process (col. 14, lines 15-22; Fig. 26, element 231). *It should be noted that "scanning" is analogous to "searching."*

Haskin and Armangau are analogous art because they are from the same field of endeavor, that being file system snapshots.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply Armangau's background copy routine to Cameron's snapshot creating process because all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded the predictable results of optimal utilization of the resources available during snapshot creation.

Therefore, it would have been obvious to combine Cameron and Armangau for the benefit of obtaining the invention as specified in claims 40 and 42.

40. **As per claim 41**, Cameron discloses a data storage system, comprising:

a writable virtual disk (vdisk) created at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at a location referencing data which has not been changed since the writable vdisk was created (col. 1, lines 61-64; col. 7, lines 14-17; Fig. 1, element 202; Fig. 7, element 602); *See the citation note for the similar limitation in claims 23 and 39 above.*

a backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created (col. 7, lines 18-20; Fig. 1, element 204-j; Fig. 7, element 604); *See the citation note for the similar limitation in claims 23 and 39 above.*

a processor to search each field of the writable vdisk for a hole; and the processor to reference each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created (col. 2, lines 31-35; col. 7, lines 18-24). *See the citation note for the similar limitation in claims 23 and 39 above.*

Cameron does not disclose searching done by a background task processor.

Armangau discloses searching done by a background task processor (col. 14, lines 15-22; Fig. 26, element 231; col. 19, lines 35-46; Fig. 14).

Haskin and Armangau are analogous art because they are from the same field of endeavor, that being file system snapshots.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply Armangau's background copy routine to Cameron's snapshot creating process because all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded the

predictable results of optimal utilization of the resources available during snapshot creation.

Therefore, it would have been obvious to combine Cameron and Armangau for the benefit of obtaining the invention as specified in claim 41.

Response to Arguments

41. Applicant's arguments filed March 26, 2008 have been fully considered but they are not persuasive.

42. With respect to Applicant's argument in section A (pages 17-18) of communication filed March 26, 2008, the Examiner respectfully disagrees. It appears that Applicant is misinterpreting the claim language. Applicant states,

> "Therefore, it would be impossible for the RWSS to be completely filled with 'holes' because if it was, no read operation could be performed because there would be no data." (see page 18)

Based on this statement, it appears Applicant is alleging a "hole" as a location on the writable vdisk where there is no data. However, based on Applicant's own claim language, such an allegation as to the nature of a "hole" is in error. Applicant's claims state,

> "…where each hole is at a location referencing data which has not been changed since the writable vdisk was created." (see claims 1, 19, 20, 23, 31, 39, and 40-42)

The cited claim language above clearly shows that Applicant's "hole" is actually data that has not been modified (i.e. dirtied) since the creation of the writable vdisk. In other words, Applicant's "hole" is simply data that has remained unmodified (i.e. clean) since

the writable vdisk was created. Therefore, Applicant's interpretation that a "hole" is a location on the writable vdisk where there is no data is not commensurate with the language of the claims and therefore incorrect.

As discussed in the rejection above, for a distinct period of time between when RWSS 202 is created and when RWSS 202 receives its first write, RWSS 202 is completely filled with all "holes" (i.e. data which has not been changed since RWSS 202 was created) because none of the data on RWSS 202 has been modified (i.e. dirtied) by a write operation. Thus, Cameron's RWSS 202 is analogous to Applicant's writable vdisk. Accordingly, Cameron sufficiently discloses creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole is at a location referencing data which has not been changed since the writable vdisk was created.

43. With respect to Applicant's argument in section B (pages 18-20) of communication filed March 26, 2008, the Examiner respectfully disagrees. It appears that Applicant is arguing a situation in Cameron that is separate from the situation in Cameron cited by the Examiner as disclosing the claim language. In other words, it appears that Applicant's arguments are based on a process that occurs after ROSS 204-j is created, however, the Examiner cites a process that occurs before ROSS 204-j is created as disclosing the claim language. Applicant cites a portion of Cameron's specification which states,

> "In action 608, the storage management program determines if this is the first write to that data block since the most recent snapshot was created in action 604 by searching for the data block in the most recently created snapshot (e.g., by traversing the address tables associated with ROSS 204-j)." (see col. 7, lines 25-30)

The cited portion of Cameron above clearly shows that this process occurs after the most recent snapshot was created (i.e. after ROSS 204-j is created).

However, the Examiner has cited a process that occurs before ROSS 204-j is created. As discussed in the rejection above, between the time RWSS 202 is created and ROSS 204-j is created, there are no writes to RWSS 202, therefore, all the blocks in RWSS 202 are "holes." Thus, at the point in time when ROSS 204-j is created from RWSS 202, in effect all the "holes" (i.e. blocks) in RWSS 202 are "searched" in order for each hole/block in RWSS 202 to be properly referenced to point to the corresponding block referenced by ROSS 204-j. Said otherwise, the mere creation of ROSS 204-j from RWSS 202 [in the case where this occurs before there have been any writes to RWSS 202] inherently requires Cameron to perform both the "searching" and "referencing" as described in the claim language. Thus, Cameron's RWSS 202 is searched for "holes" before the creation of ROSS 204-j. Accordingly, Camerson sufficiently discloses searching each field of the writable vdisk for a hole.

44. With respect to Applicant's argument in section C (pages 20-21) of communication filed March 26, 2008, the Examiner respectfully disagrees. Contrary to Applicant's allegation, the Examiner did not intend to assert that Cameron's ROSS 204-j is analogous to Applicant's vdisk. Based on the discussion directly above, the Examiner maintains the interpretation that Cameron's RWSS 202 is analogous to Applicant's

vdisk and Cameron's ROSS 204-j is analogous to Applicant's backing store. As Applicant themselves admit, "the RWSS 202 contains the data which has been changed (i.e. the write)" (see page 21). Thus, Cameron's RWSS 202 is analogous to Applicant's vdisk because RWSS 202 references both the data which is unchanged since RWSS 202 was created and the data which has been changed since RWSS 202 was created. Accordingly, Cameron sufficiently discloses referencing each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created.

45. With respect to Applicant's argument regarding the 103 rejection (pages 21-23) in communication filed March 26, 2008, the Examiner respectfully disagrees and refers Applicant to sections 38-40 of the current Office action.

46. With respect to Applicant's argument regarding the new claims (page 24) in communication filed March 26, 2008, the Examiner respectfully disagrees and refers Applicant to sections 38-40 of the current Office action as well as the rejection of claims 40-42 above.

47. As for Applicant's arguments with respect to the dependent claims, the arguments rely on the allegation that the independent claims are allowable and therefore for the same reasons the dependent claims are allowable. However, as addressed above, the independent claims are not allowable, thus, Applicant's arguments with respect to the dependent claims are not persuasive.

Conclusion

STATUS OF CLAIMS IN THE APPLICATION

The following is a summary of the treatment and status of all claims in the application as recommended by MPEP 707.70(i):

CLAIMS REJECTED IN THE APPLICATION

Per the instant office action, **claims 1-15, 19, 20, and 23-42** have received a second action on the merits and are subject of a second action final.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arpan P. Savla whose telephone number is (571)272-1077. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sanjiv Shah can be reached on (571) 272-4098. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Arpan Savla/
Examiner, Art Unit 2185
June 22, 2008

/Sanjiv Shah/
Supervisory Patent Examiner, Art Unit 2185